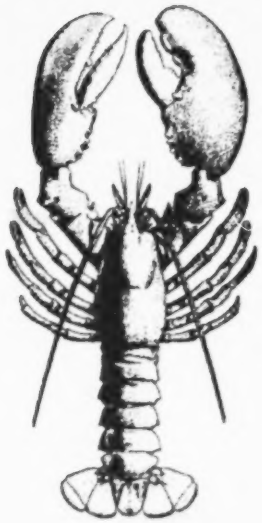
Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences
Canadian Science Advisory Secretariat
Gulf Region | Science Response 2014/027

REFERENCE POINT OPTIONS FOR THE SOUTHERN GULF OF ST. LAWRENCE LOBSTER STOCK (LOBSTER FISHING AREAS 23, 24, 25, 26A, 26B)



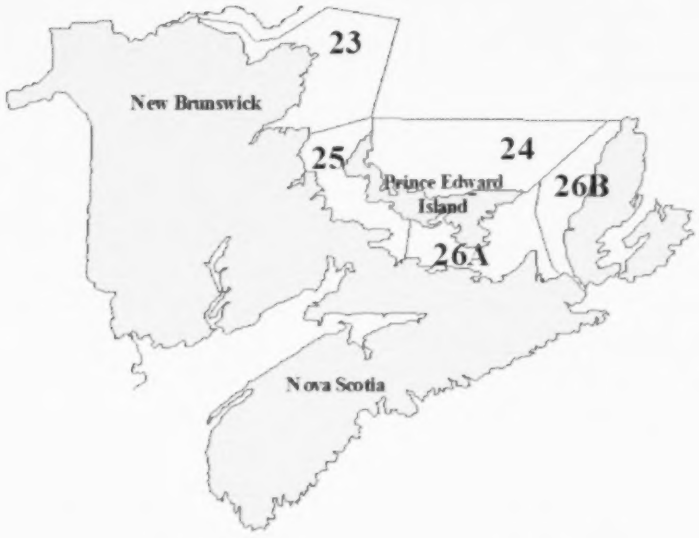


Figure 1. Lobster Fishing Areas in the southern Gulf of St. Lawrence.

Context

The last assessment for the lobster stocks of the southern Gulf of St. Lawrence (sGSL) was completed in 2013 (DFO 2013c). The lobster fishery in this area is an input control fishery managed using measures that control effort and size of animals at harvest. Total allowable catches for the fishery or individual harvesters are not established. Reference points (RPs) have not been defined for this stock. During the recent stock assessment, it was indicated that the definition and application of RPs to the sGSL stock required further analyses and review.

RPs have been defined for lobster stocks in Lobster Fishing Area (LFA) 22 in the Quebec Region (DFO 2012a), and LFAs 27-38 of the Maritimes Region (DFO 2012b, DFO 2013a, 2013b; Tremblay et al. 2012). Since no biomass estimates for stock abundance were available, landings from a productive period were used as a stock status indicator and median or mean landing values corresponding to the productive period were used as a proxy to define maximum sustainable yield. The limit reference point, upper stock reference point, and the stock status zones (healthy, cautious, and critical) were defined in accordance with the DFO operational policy framework (DFO 2009). This science response report is the result of the Science Response Process of November 21, 2013. It describes options for RPs for the sGSL lobster stock, based on the method used in the Quebec and Maritimes Regions, and discusses alternatives to the approach currently used. Data collection requirements are also summarized.

Canada

Background

In 2009, Fisheries and Oceans Canada (DFO) published the Sustainable Fisheries Framework, which establishes a decision-making framework incorporating the Precautionary Approach (PA) (DFO 2009). The framework has three main components: (1) definition of Reference Points (RP) and delineation of stock status zones, (2) harvest strategy and decision rules, and (3) incorporation of uncertainty and risk assessment.

Within the first component of the PA, the limit reference point (LRP) represents a threshold below which stock productivity is expected to be severely compromised, i.e., the critical zone (Figure 2). According to the decision-making framework (DFO 2009), a stock is considered to be in the critical zone if the stock status indicator is less than or equal to 40% of the biomass for maximum sustainable yield (B_{MSY}). Similarly, a stock is considered to be in the healthy zone if the stock status indicator ≥ 80% of B_{MSY}; 80% of B_{MSY} corresponding to the upper stock reference (USR). The stock is considered to be in the cautious zone if the stock status index is between the LRP and the USR, i.e., > 40% of B_{MSY} but < 80% of B_{MSY}.

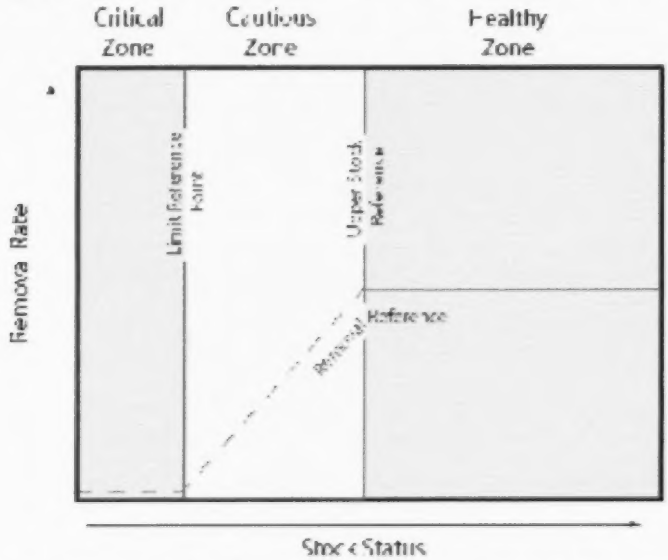


Figure 2. Illustration of the fishery decision-making framework with three status zones and the corresponding stock status and removal rate reference points (DFO 2009).

Workshops in 2010 (DFO 2010) and 2012 (Smith et al. 2012) were carried out to guide the implementation of the PA framework for invertebrates fisheries in Canada. The goal of the 2010 workshop was to address the first component of the PA framework and determine potential indicators that could be used to define the stock status zones for lobster fisheries in Quebec and the Atlantic provinces (DFO 2010). Following this workshop, a review was conducted by an external consultant on behalf of DFO (unpublished report). A series of recommendations and specific measures for implementing the PA were proposed taking into consideration regional and biological conditions in all Lobster Fishing Areas (LFA). The proposed guidelines could also be used to support the lobster fishing industry's submission for eco-certification (DFO unpublished report).

For LFA 22 (Quebec Region), LFA 34 and LFAs 35 to 38 (Maritimes Region), landings were used as the stock status indicator. In the absence of mandatory dockside weighing in all Regions, landings are compiled from purchase slips in the Quebec Region (DFO 2012a), and from sale slips and the catch and settlement report program (i.e., logbooks) in the Maritimes

Region (DFO 2013a, 2013b). Effort was considered to be relatively homogeneous during the period from 1985 to 2009 and the trend in landings suggested that this was a period of high production and abundance of lobster. The mean or median values of the landings for that period were considered a proxy for BMSY. In all these areas in recent years, the stocks were considered to be in the healthy zone.

Previous DFO advice on RPs for lobster emphasized the importance of monitoring a suite of secondary indicators to better understand or validate landings as the stock status indicator (DFO 2013a, 2013b). Secondary indicators related to abundance, productivity, fishing pressure and ecosystem considerations are considered important for assessing stock status and to refine the RPs (Smith et al. 2012).

Analysis and Response

There are no biomass indicators for lobster in the southern Gulf of St. Lawrence (sGSL). Catch records for the lobster fishery date back to 1892 and landings from DFO Gulf Region since the early-1980s are compiled from purchase slips provided by registered buyers. There is no mandatory logbook program or mandatory dockside weighing of the catch in the Gulf Region. There are concerns about the accuracy and delays in availability of the landings data from this reporting system (DFO 2013c).

The approaches used in the other DFO Regions to define the productive period and the proxy for B_{MSY} were applied to the lobster stock from the sGSL. Landing trends and information on nominal effort (number of licences) were used to establish the period of high production which was also characterized by small changes in fishing effort. Landings during this period of high production were then used as a proxy for B_{MSY}.

Reference time period

Although a "reasonable timeframe" that correspond to a period of 1.5 to 2 generations was originally suggested for management actions linked to the stock recovery out of the critical zone (DFO 2009), it later served for the definition of the reference period to estimate landings-based biomass proxies (Gendron and Savard 2012; Tremblay et al. 2012). The 25-year reference period (1985-2009) was selected by both Quebec and Maritimes Regions because it was a productive period, included several lobster generations, and the years prior to 1985 had significantly lower levels of fishing effort.

For the sGSL, the period from 1974 to 2009 was selected as the reference period. Following the implementation of the limited access policy in 1967 (DeWolf 1974), the number of fishing licenses was reduced. While there was a further reduction in the number of licences in the period 1976-1980 through a buy-back program, many of the licenses were inactive and thus the amount of effort is considered to have remained relatively constant between 1974 and 2009. Significant reductions in the number of licenses and total trap allocations occurred after 2009 (DFO 2013c). The 1974-2009 period includes a year with one of the lowest landings (1974), which was followed immediately by a sharp and uninterrupted increase to historical and generally sustained high landings (Figure 3).

Selecting the appropriate area

Management of the lobster fishery in the Gulf Region is structured into five LFAs (Figure 1) with the fishery in four LFAs (LFA 23, 24, 26A and 26B) operating in May and June, while the fishery in LFA 25 runs from mid-August to mid-October. There are no physical features (such as a cold intermediate layer or landmasses) that restrict benthic stage exchanges or movements between LFAs in the sGSL, although measured movements of lobsters are limited in scale (Comeau and Savoie 2002). At the larval stage, there is extensive pelagic connectivity between LFAs in the

sGSL as documented from a larval drift model (Comeau et al. 2008; Chassé and Miller 2010) with a general west to the east water movement, but with some restrictions in central Northumberland Strait (Comeau et al. 2004, 2008; DFO 2013c). As a result, lobsters in the sGSL are considered as a single biological unit.

Proposed reference points

Landings are used as the stock status indicator and as a proxy for the estimation of B_{MSY}. The median landing for the 1974-2009 period for the entire sGSL is proposed as a proxy value for B_{MSY}. The USR value is defined as 80% of B_{MSY} and the LRP is defined as 40% of B_{MSY} (DFO 2009) (Table 1; Figure 3). Landings from 2011 indicate that the stock is in the healthy zone, above both the USR and B_{MSY} values (Table 1). Preliminary lobster landings for 2012 and 2013 in the Gulf Region indicate higher values than those of 2011.

The landings between 1916 and 1976 fluctuated around the LRP value as defined above (Figure 3). It is unknown whether the LRP as defined is actually a limit below which serious harm would occur to the stock. Based on historical trends in the sGSL, landings increased to historical record values after 1974. That increase, which occurred over the entire geographical range of the species, is most likely due to favorable ecosystem conditions that occurred beginning in the late 1960s and 1970s.

Table 1. Values of lobster landings corresponding to the proxy for biomass at maximum sustainable yield (B_{MSY}), the upper stock reference (USR), and the limit reference point (LRP) for the entire southern Gulf of St. Lawrence lobster stock. The 2011 landings and the position of the stock in 2011 within the status zones is shown (healthy, landings ≥ USR; cautious, USR > landings > LRP; and critical, landings ≤ LRP).

Period	B_{MSY} proxy	USR (80% B_{MSY})	LRP (40% B_{MSY})	2011 landings	Stock status zone
1974-2009	17,247 t	13,798 t	6,899 t	19,062 t	Healthy

Many factors (e.g., fishing effort, catchability, and data accuracy) other than changes in stock abundance could affect landings. Although data on the effective effort are not available, there were reductions in the nominal effort beginning in 2010 associated with reductions in the number of fishing licences and trap allocations in the sGSL lobster fisheries. Nominal effort, described as the maximum trap allocation per day and per region, was reduced by 12% between 2006 and 2012, mostly starting in 2010. These reductions in fishing effort did not translate into lower landings, suggesting that the stock productivity remained high in recent years (DFO 2013c). Landings are also influenced by catchability which in turn is affected by environmental conditions (Drinkwater et al. 2006), gear efficiency (including trap design and bait) and lobster behavior. Data on harvesters' daily fishing activities (e.g., fishing effort, landings) are not available and there is no dockside monitoring of landings. Landings are based on purchase slips which record sales to registered buyers and do not account for lobster which are kept for personal use or sold to individuals. Nevertheless, if the bias in reported lobster landings is consistent over time, the trends can be considered reliable.

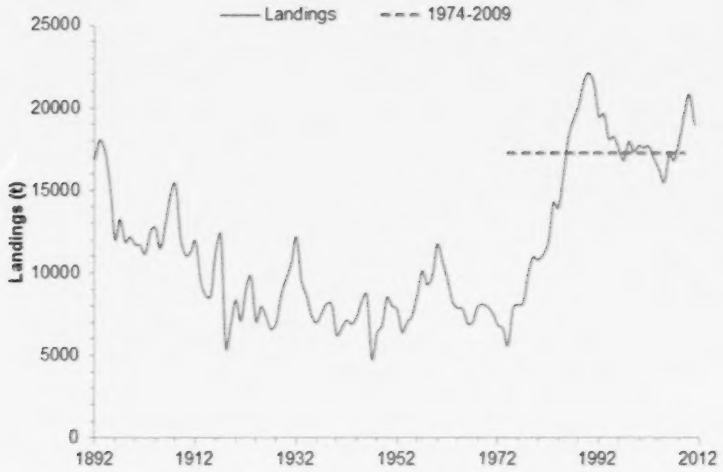


Figure 3. Lobster landings (t) in the southern Gulf of St. Lawrence fishing areas from 1892 to 2011. The median landings for the 1974-2009 reference period (dotted red line; 17,247 t) are used as a proxy for B_{MSY}.

Other potential stock status indicators

Other indicators used in the lobster stock assessment provide information on the stock's abundance and productivity as well as on fishing pressure and on ecosystem considerations (Comeau et al. 2008; DFO 2013c). Although new indicators could be proposed in the future, for now landings are the primary indicators available as an option for defining RPs for the sGSL lobster fisheries. With the uncertainties about the completeness of the reported landings, there is a need to consider other fishery-dependent and fishery-independent indices of stock status.

The Quebec and Maritimes Regions have validated the use of landings as a proxy for biomass based on positive correlations between landings and trawl survey indices (Gendron and Savard 2012; Tremblay et al. 2012). In the Maritimes Region, biomass proxy and USRs have also been defined from trawl survey data although these surveys were not targeting lobster, had a limited coverage, and relatively short time series (Tremblay et al. 2012). An annual lobster-targeted trawl survey in the sGSL has been conducted annually since 2000 in LFAs 25 and 26A but because of its short time series, limited geographical coverage, and changes in design over time, abundance indices derived from the survey were not considered to be a suitable index of abundance for developing RPs. No correlations were found between sGSL lobster landings and the catch rate index from the trawl survey (r^2=0.09).

Fishery-dependent CPUE data are available in the sGSL from at-sea sampling activities and the voluntary recruitment-index program. CPUEs are incorporated in the suite of abundance indicators in the sGSL stock assessment (DFO 2013c). However, the time series are not consistent across the LFAs and the sampling intensity is not equally distributed. The at-sea sampling and recruitment-index programs were initiated by DFO Science in 1982 and 1999, respectively, but both ended around 2003. These monitoring activities are now conducted in the LFAs around PEI (24, 25, 26A) by the provincial government, and occasionally elsewhere on an irregular basis by harvester associations (DFO 2013c). In the Maritimes Region, commercial CPUE data from the mandatory logbook program were used to develop RPs as these indices were positively correlated with landings (Tremblay et al. 2012). In the sGSL, no correlation was observed between landings and CPUEs based on at-sea sampling data (r^2=0.24) and from the recruitment-index program (r^2=0.14).

A population model developed by the University of Maine has been applied to lobster stocks and fisheries in the United States (US) (Chen et al. 2005). The adaptation of the US model to Canadian stocks will require considerable work as there are many differences between the US and Canadian lobster stocks and fisheries (J. Tremblay, DFO, Unpubl. Rep.). Population models that incorporate information from indices of abundance of pre-recruits and/or berried females could be considered to monitor the stock productivity and to better understand productive capacity.

Removal rate reference in the healthy zone

It is generally recognized that exploitation rates on Canadian lobster stocks are high (FRCC 2007). Exploitation rate indices for various LFAs of the sGSL fisheries, estimated using two different approaches, had mean values for the 1999 to 2011 period ranging from 47% to 81%, but are potentially biased because of violation of the underlying assumptions of the methods (DFO 2013c). As calculated, the exploitation rate indices account for all losses of lobster whether from reported landings, unreported landings, and natural mortality. In that sense, the exploitation rate values are higher than the realized exploitation rate by the fishery (reported and unreported). Under current conditions, high lobster landings have been sustained or even increased over the past 25 years at these levels of exploitation.

Conclusions

Defining RPs for the sGSL lobster stock in terms of the PA framework is difficult because of the lack of key quantitative data including biomass indices and reliable exploitation rate estimates.

The lobster population from the sGSL is considered as a single biological unit. Landings from the fisheries in the sGSL are used to infer a period of high and sustained production of lobster. Considering that the nominal effort in terms of total fishing licences has been relatively homogeneous since 1974, the landings during the period 1974 to 2009 are considered to have resulted from a productive period covering about six lobster generations. The median value of the landings in this period is proposed as a proxy for B_{MSY}. The USR and LRP are calculated as 80% and 40% of B_{MSY}, respectively. The 2011 landings are above the USR and B_{MSY} reference values and the stock is therefore considered to be in the healthy zone.

Under the present management regime (i.e.; input control fishery) and fisheries data collection programs, landings are considered to be poor indicators of stock status. As a result, landings should be considered as temporary proxies for B_{MSY} and reference points. The assessment of the state of the resource within the PA status zones using landings will only be appropriate provided no significant management interventions are made. It is difficult to propose appropriate management actions that could halt the decline of a stock status indicator into the cautious zone when the stock status indicator is based on landings. For example, any management action to reduce the removal rate as the stock moves into the cautious zone, as per the PA policy, could have the immediate result of further decreasing the landings, making the landings as indicators inappropriate.

Presently, the few fishery independent monitoring programs conducted in portions of the sGSL are not adequate to assess the status of lobster in the entire sGSL. Alternative indices that warrant consideration in the short term include data collected as part of the voluntary recruitment-index logbook programs. This program can provide data from which exploitation rates can be estimated, as well as demographic characteristics of pre-recruits and recruits to the fishery (Comeau et al. 2009; DFO 2013c). If adequate estimates of exploitation rates can be derived, than indices of biomass can be developed. The implementation of a mandatory logbook program could provide detailed spatial and temporal data on effort and catches, with which to develop spatially segregated indices of abundance. Ultimately these demographic, abundance,

and exploitation rate indices would be used to develop population models for the sGSL lobster stock with the objective of identifying appropriate RPs and advising on harvest control rules that would conform to the PA.

Contributors

Name	Affiliation
Michel Comeau	DFO Science Gulf Region
Amélie Rondeau	DFO Science Gulf Region
Christian Brun	Union des pêcheurs des Maritimes
Michael Chadwick	Université de Moncton
Gérald Chaput	DFO Science Gulf Region
Réginald Comeau	Union des pêcheurs des Maritimes
Jean Côté	Regroupement des pêcheurs professionnels du sud de la Gaspésie
Ed Frenette	Mi'kmaq Confederacy of Prince Edward Island
Jamie Gauthier	Prince Edward Island Fishermen's Association Ltd.
Louise Gendron	DFO Science Quebec Region
Marcel Hébert	DFO Science Gulf Region
Ronnie Heighton	Northumberland Fishermen's Association
Marc Lanteigne	DFO Science Gulf Region
Lee Knox	Prince Edward Island Fishermen's Association Ltd.
Léonard LeBlanc	Gulf Nova Scotia Fishermen's Coalition
Mike McGeoghegan	Prince Edward Island Fishermen's Association Ltd.
Daniel McLaughlin	DFO Resource Management Gulf Region
Laura Ramsay	Prince Edward Island Fishermen's Association Ltd.
Emmanuel Sandt-Duguay	Mi'kmaq Maliseet Aboriginal Fisheries Management Association
Doug Swain	DFO Science Gulf Region
John Tremblay	DFO Science Maritimes Region
Devin Ward	North Shore Micmac Council, NB

Approved by

Ghislain Chouinard
Regional Director Science Branch
Gulf Region

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This Science Response Report results from the Science Response Process of November 21, 2013 on the review of options for reference points for the lobster stock of the southern Gulf of St. Lawrence.

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